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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/937,208

05/28/2002

David K. Benson

NREL 99-03

6631

7590

06/01/2006

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EXAMINER

MOSS, KERI A

ART UNIT

PAPER NUMBER

1743

DATE MAILED: 06/01/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/937,208

Applicant(s)

BENSON ET AL.

Examiner

Keri A. Moss

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on 01 March 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 10 and 12-39 is/are pending in the application.
- 4a) Of the above claim(s) 14-18 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 10, 12-13, 19-39 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Amendment filed on March 1, 2006 has been acknowledged. Applicant has withdrawn claims 1-9 and 11 and added claims 28-39. Claims 10, 12-13 and 19-39 are pending.

Election/Restrictions

are
1. Claims 14-18[^] withdrawn from further consideration pursuant to 37 CFR 1.142(b), as being drawn to a nonelected invention, there being no allowable generic or linking claim. Applicant timely traversed the restriction (election) requirement in the reply filed on March 1, 2006.

2. Applicant's election with traverse of claims 1-13 and 19-33 in the reply filed on March 1, 2006 is acknowledged. The applicant did not specify the grounds on which the traversal is based. The requirement is still deemed proper and is therefore made FINAL.

Response to Amendment

3. Applicant's arguments, see Amendment filed under 37 CFR 1.111, filed March 1, 2006, with respect to the rejection(s) of claim(s) 1-13 and 19-33 under Koide, Jelley, Mansfield, Szuchy, Carter, Cramp and Benson have been fully considered and are persuasive. Therefore, in light of the amendments to the claims, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made

over Freeman in view of Bevenot and further in view of Seibert and further in view of Young and further in view of Takahashi.

Claim Rejections - 35 USC § 103

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claims **10, 12-13, 19, 22-28, 32-33, 37-39** and are rejected under 35 U.S.C. 103(a) as being unpatentable over Freeman (USP 5,279,169) in view of Bevenot (USP 6,185,344). Freeman discloses a diffusible hydrogen sensor apparatus for detecting hydrogen diffusing from a solid metal object, comprising a sensor housing (Fig. 1 parts 5, 6, 9, 10, 11 and 13) with a sealing member 5 attached thereto disposed to surround a leak proof predetermined sample area (column 4 lines 3-8) of an object to be measured (Fig. 1 part 1); the sensor housing has a predetermined sample volume (column 4 lines 9-15) within the housing adjacent to the sample area to define a leak proof sample chamber enclosing the object to be measured (column 4 lines 3-8); a hydrogen sensor (part 6) mounted in the sensor housing with a sealed connection to the leak proof sample chamber (column 4). The rate of hydrogen gas accumulation in the sample chamber is directly related to the surface area of the first surface monitored (column 6 lines 19-55) and physical properties of the chamber are used to calculate the quantity of hydrogen present (column 4), as the decay in the vacuum indicates the rate of diffusion of hydrogen atoms through the material being sampled (column 4).

Freeman further discloses a method of measuring a diffusible hydrogen diffusing from an object comprising selecting a portion of the object from which to obtain a diffusible hydrogen concentration measurement by selecting a portion of the object (column 3 lines 60-67); sealably mounting a hydrogen sensor assembly on the selected portion of the object (column 4 lines 3-9), wherein the sensor housing defines a predetermined sample volume in which the sample is captured (column 4 lines 9-15); allowing the hydrogen sensor to react with the captured evolving hydrogen for a sample time (column 4 lines 20-30); and measuring change in physical property of the hydrogen sensor over said sample time (column 4 lines 30-35). Freeman calculates the rate of hydrogen diffusivity in a sample (see Figure 4) as well as the rate of change of hydrogen in the sample volume (see Figure 5).

Freeman does not disclose a light source optically connected to the sensor housing to transmit light to the hydrogen sensor nor a sensor layer of hydrogen-reactive chemochromic material wherein the properties of light reflected from the layer of hydrogen-reactive chemochromic material varies as a function of hydrogen concentration nor a detector and signal analyzer that receives reflected light. Nor does Freeman disclose a method of measuring the diffusible hydrogen concentration.

In Figure 2, Bevenot discloses a hydrogen sensor comprising a layer of hydrogen-reactive chemochromic material (column 5 lines 1-31). Applicant defines chemochromic as an electrical or optical property change in response to hydrogen (specification p.10 lines 10-28) and the sensor in Bevenot respond to the presence of hydrogen by changing its optical properties (column 6 lines 1-6). Bevenot also

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discloses a light source (part 24) optically connected to a sensor (part 20) to transmit light to the hydrogen sensor wherein the properties of light reflected from the layer of hydrogen-reactive material varies as a function of hydrogen concentration (column 6 lines 1-6); and a detector (part 26) and signal analyzer (part 27) connected to the sensor housing for receiving the reflected light from the layer of hydrogen-reactive chemochromic material (part 20) wherein the reflected light is detected and analyzed by the signal analyzer (part 27) to correlate the variations in the light input to a quantity of hydrogen in the sample volume (column 3 line 45- column 4 line 20). The reflector layer of palladium may have a thickness of between 10 and 50 nm (column 3 lines 23-26). The light source is a laser inherently emitted as collimated light (column 4 lines 50-67) emitted in infrared wavelength (750nm to 1 mm) and an intensity of milliwatts (column 6). With respect to claims 13, 32 and 37, the light intensity and bandwidth range are result effective variables. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980) teaches that optimization of a result-effective variable is ordinarily within the skill of one in the art. A result-effective variable is one that has well-known and expected results. Varying the bandwidth range or intensity of a light beam has the well-known and expected result of detecting optical changes in optical sensors and enabling the light to pass through a layer of sensor material as well as heating the sensor layer. Therefore, it would have been obvious to one of ordinary skill in the art to meet the bandwidth and intensity requirements of claimed bandwidth range from white light to single wavelength infrared and light source intensity of about 1 to 3 microWatts by modifying Bevenot and selecting the bandwidth range and light intensity in order to detect optical

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changes in the sensor material chosen and to enable the light to pass through the sensor without overheating it.

It would have been obvious for one of ordinary skill in the art to modify the hydrogen monitoring apparatus of Freeman with Bevenot's optical device for determining hydrogen concentration. Bevenot's device offers the capability of detecting small traces of gaseous hydrogen and the additional advantage of determining hydrogen concentrations. Therefore, it would have been obvious to one of ordinary skill in the art to combine Freeman's sealed chamber with Bevenot's optical device to have a device that detects hydrogen emitting from a sample area and to gain the additional advantage of determining the diffusible hydrogen concentration.

It further would have been obvious to one of ordinary skill in the art to correlate the change in the Bevenot chemochromatic sensor material by comparing a predetermined relationship between the physical property measured and concentration of hydrogen to obtain a rate of change of hydrogen in the sample volume during the sample period which corresponds to hydrogen diffusivity rate from the object and determining the diffusible hydrogen concentration in the selected portion of the object based on the measured amount of change in the physical property of the hydrogen sensor by correlating the rate of change of hydrogen in the sample volume via a predetermined relationship between rate of change of hydrogen in the sample volume to diffusible hydrogen concentration in the object. As mentioned above, Freeman teaches calculating the rate of hydrogen diffusivity from a sample as well as the rate of change of hydrogen diffusivity. Bevenot teaches that the optical properties of the palladium film

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vary as a function of the concentration of hydrogen. Therefore, it would have been obvious to combine Freeman and Bevenot to calculate the diffusible hydrogen concentration in the sample volume and to further correlate the rate of change of hydrogen in the sample volume via the predetermined relationship between the rate of change of hydrogen in the sample volume to the diffusible hydrogen concentration in the object.

With respect to claims **25-27, 33 and 38-39** it further would have been obvious to one of ordinary skill in the art to calibrate the sensor and its processing circuits. Calibration of the sensor, and more specifically, the detector and processing circuits is inherent in Bevenot and inherently includes a calibration of the changes of light detected with changes in hydrogen concentration with a plurality of samples with known hydrogen concentrations. It is obvious to those with ordinary skill in the art to calibrate prior to use. Freeman teaches using a predetermined sample area and volume in order to calculate changes in hydrogen concentration in a fixed volume sample holder (columns 8-9). It would have been obvious to one with ordinary skill in the art to combine the methods of Bevenot and Freeman to calibrating the sensor by correlating the change in light detected to the rate of change in the volume of hydrogen for the predetermined sample volume in order to enable the sensor processing circuits to determine when the sample volume has been filled with hydrogen. Therefore, it would have been obvious to one of ordinary skill in the art to calibrate the sensor by correlating the change in light detected to the rate of change in the volume of hydrogen for the predetermined sample volume.

6. Claims **29-31** and **34-36** are rejected under 35 U.S.C. 103(a) as being unpatentable over Freeman and Bevenot as applied to claim 28 above and further in view of Seibert (USP 6,277,589). Seibert teaches a chemochromic sensor material comprising a transition metal oxide in the first layer and a second catalytic material selected from either palladium or platinum, which are inherently reflective. The reflective catalytic layer is located between the hydrogen sample volume and the chemochromic sensor material. Seibert teaches that this sensor changes color in response to hydrogen and that the color change becomes more intense as the concentration of hydrogen increases (column 4 lines 33-52). In addition, the film color returns to its original state when hydrogen gas is removed from the area, making the color change reversible and allowing reuse of the sensor. Therefore, it would have been obvious to one of ordinary skill in the art to modify the apparatus of Freeman and Bevenot with the sensor material of Seibert in order to have a sensor with color intensity that reflects hydrogen concentration, making for reliable determination of hydrogen concentration. An additional advantage of modifying with Seibert is to be able to reuse the sensor.

7. Claim **20** is rejected under 35 U.S.C. 103(a) as being unpatentable over Freeman and Bevenot as applied to claim 19 above in view of *In re Boesch*. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980) teaches that optimization of a result-effective variable is ordinarily within the skill of one in the art. A result-effective

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variable is one that has well-known and expected results. The selection of time the hydrogen sample is allowed to interact with the sensor is a result effective variable. Varying the length of time has the well-known and expected result of producing or not producing a resulting change in the optical properties of the sensor material. Therefore, it would have been obvious to one of ordinary skill in the art to meet the time length requirements of claimed 10 to 30 minutes by modifying Freeman and Bevenot and selecting the length of time in order to obtain the optical changes in the sensor material.

8. Claim **21** is rejected under 35 U.S.C. 103(a) as being unpatentable over Freeman and Bevenot as applied to claim 19 and 20 above, and further in view of Young (USP 6,120,936) and further in view of Takahashi (USP 4,475,963). Young shows that hydrogen diffusion rate is well known in the art of metalworking and is a measure of the mobility of hydrogen through a metal (column 9 lines 16-30). As with all calculations of rate, the multiplication of time by the rate yields the change in the variable being measured, in the case at hand - the multiplication of "cooling time" with the hydrogen diffusion rate results in the hydrogen concentration after a specified period of time. Because initial hydrogen concentration is an important variable in the art of welding to prevent cracking of the metal (Takahashi column 1), it would have been obvious to one skilled in the art at the time of invention, to determine initial hydrogen concentration in the welded joint after a cooling time by multiplying the hydrogen diffusivity rate by cooling time.

Response to Arguments

Applicant's arguments filed on March 1, 2006 have been fully considered in light of the amendments and they are persuasive. Examiner submits new grounds of rejection in view of the amendments.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

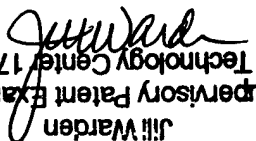
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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Keri A. Moss whose telephone number is 571-272-8267. The examiner can normally be reached on 9-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jill Warden can be reached on (571)272-1700. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

KAM 5/30/06


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